

# P a t e n t   C l a i m s

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1            1. A device for need-controlled modulation of  
2 physiological and/or pathological neuronal rhythmic activity,  
3 comprising a control unit (4), a stimulator (1) and at least one  
4 means for detecting brain activity (2) which is connected with the  
5 control unit (4).

1            2. The device according to claim 1, characterized in  
2 that the stimulator (1) is at least one component from the group  
3 comprising a display screen, a pair of shutter-equipped eyeglasses,  
4 a loud speaker, headphones, a pressure generator and a time-  
5 modulated laser.

1            3. The device according to claim 1 or 2, characterized  
2 in that the means for detecting brain activity is at least one  
3 component from the group comprised of a scalp EEG electrode or a  
4 MEG electrode.

1            4. The device according to one of claims 1 to 3,  
2 characterized in that the means for detecting brain activity is  
3 connected with the control unit (4) by an isolating amplifier (3).

1           5. The device according to one of claims 1 to 4,  
2 characterized in that it comprises a means for feedback of a  
3 patient reaction (5) which is connected to the control unit (4).

1           6. The device according to one of claims 1 to 4,  
2 characterized in that it comprises means for evoking a maximum  
3 physiological and/or pathological brain activity.

1           7. The device according to claim 6, characterized in  
2 that it comprises means for carrying out a frequency scan.

1           8. The device according to one of claims 1 to 7,  
2 characterized in that it comprises means for quantifying the  
3 neuronal activity.

1           9. The device according to claim 8, characterized in  
2 that the means for quantifying the neuronal activity is a means for  
3 quantifying the amplitude of the power spectrum over the excitation  
4 frequency range or a means for quantifying the instantaneous  
5 amplitude of the frequency range as determined by the Hilbert  
6 transformation.

1           10. The device according to one of claims 1 to 9,  
2 characterized in that the control unit (4) is joined with a means  
3 for actuating the stimulator (1).

1           11. The device according to one of claims 1 to 10,  
2 characterized in that it includes means for investigating the  
3 signals measured by the sensor (2).

1           12. The device according to claim 11 wherein the means  
2 for investigating the signals measured by the sensor (2) carries  
3 out a Fourier transformation or a wavelet analysis.

1           13. The device according to claims 11 or 12,  
2 characterized in that it comprises means for registering the change  
3 in the amplitude of the rhythm to be excited.

1           14. The device according to one of claims 1 to 13,  
2 characterized in that it comprises means for carrying out an  
3 entrainment.

1           15. The device according to one of claims 1 to 14,  
2 characterized in that it comprises means for desynchronization.

1           16. The device according to one of claims 1 to 15,  
2 characterized in that it comprises means for testing the quality  
3 of the entrainment.

1           17. The device according to claim 16, characterized in  
2 that the means for testing the quality of the entrainment comprises

3 a means for determining the phase or the phase and the amplitude of  
4 the neuronal rhythm to be desynchronized.

1 18. The device according to claim 17, characterized in  
2 that the means for determining the phase and amplitude of the  
3 neuronal rhythm to be desynchronized carries out a Hilbert  
4 transformation or a matching of the signals of the neuronal rhythm  
5 with a slowly changing sine function in a sliding time window.

1 19. The device according to one of claims 1 to 18,  
2 characterized in that it comprises means for evaluating the phase  
3 and amplitude of the neuronal activity.

1 20. The device according to claim 19, characterized in  
2 that the means for evaluating the phase and amplitude of the  
3 neuronal rhythm contains a means for calculating phase resetting  
4 curves.

1 21. The device according to claim 20, characterized in  
2 that it comprises means for visualization (6) of the phase  
3 resetting curves.

1 22. The device according to claims 20 or 21,  
2 characterized in that it comprises means for the quantitative  
3 characterization of the phase resetting curves.

1           23. The device according to claim 19, characterized in  
2 that the means for determining the amplitude is a means by which  
3 the amplitude resetting curves are effected.

1           24. The device according to one of claims 1 to 23,  
2 characterized in that it comprises means for determining the  
3 vulnerable phase of the neuronal rhythm.

1           25. The device according to claim 24, characterized in  
2 that the means for determining the vulnerable phase is a means for  
3 varying the time spacing between the last excitation of the  
4 entrainment and the desynchronizing excitation signal.

1           26. The device according to claim 25, characterized in  
2 that the means for varying the time spacing between the last  
3 excitation of the entrainment and the desynchronizing is a means  
4 which effects a variation in the time spacing for different values  
5 of the intensity.

1           27. The device according to claims 25 or 26,  
2 characterized in that the means for varying the intensity is a  
3 means for increasing the intensity in equidistant steps.

1           28. The device according to one of claims 24 to 27,  
2 characterized in that it includes a means which enables from a

3 series of test stimulations optimal stimulation parameters to be  
4 determined.

1 29. The device according to claim 28, characterized in  
2 that it includes means which detects stimulation parameters from a  
3 series of test stimulations from which a minimization of the  
4 amplitude of the neuronal activity to be desynchronized can be  
5 obtained.

1 30. The device according to claim 29, characterized in  
2 that the means for determining the minimization of the amplitude of  
3 the stimulation parameters which give rise to a desynchronization  
4 of the rhythm comprises a means for carrying out the Hilbert  
5 transformation.

1 31. The device according to claim 29 or 30,  
2 characterized in that the means for determining the minimization of  
3 the amplitude of the stimulation parameters giving rise to a  
4 desynchronization of the rhythm comprises a means for matching a  
5 slowly changing sine function to a signal of the sensor (2) in a  
6 time window following stimulation.

1 32. The device according to one of claims 29 to 31,  
2 characterized in that the means for determining the stimulation  
3 parameters giving rise to a minimization of the amplitude of the  
4 desynchronizing rhythm comprises a means for integrating the  
5 amplitude of the power spectrum over the frequency band of signals

6 measured by the sensor (2) in a time window following the  
7 stimulation.

1 33. The device according to one of claims 20 to 32,  
2 characterized in that it comprises means for increasing the  
3 intensity in non-equidistant steps.

1 34. The device according to one of claims 20 to 33,  
2 characterized in that it comprises a means for evaluating phase  
3 resetting curves with which the effect of the desynchronizing  
4 excitation pulse on the phase dynamics of the desynchronizing  
5 neuronal activity is investigated.

1 35. The device according to claim 34, characterized in  
2 that the means for evaluating the phase resetting curves comprises  
3 a means for applying  $\phi_e$ , the phase of the neuronal activity before  
4 stimulation, over  $\phi_b$ , the phase of the neuronal activity after  
5 stimulation.

1 36. The device according to claims 34 or 35,  
2 characterized in that the means for evaluating the phase resetting  
3 curves comprises a means for determining the position of the phase  
4 resetting curve at which the transition from a main rise 1 to a  
5 main rise 0.

1           37. The device according to one of claims 1 to 36,  
2 characterized in that it includes a means for monitoring the  
3 stimulation (6).